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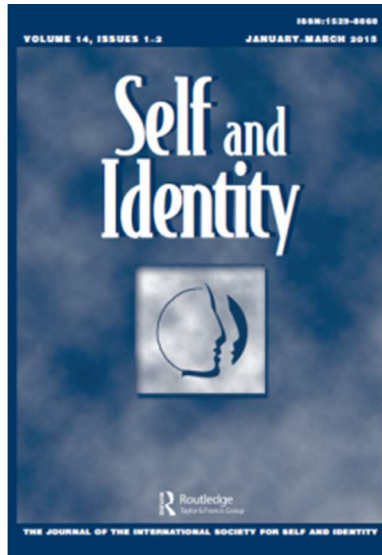
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The fusing power of natural disasters: An experimental study

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Abstract

In the first experimental test of the potential of natural disasters to produce identity fusion, we asked residents of Christchurch, New Zealand, to recall their experience of the city's devastating 2011 earthquake. Compared to a control condition, recall increased participants' fusion with their community as a positive function of the fear they felt and, independently, of the personal harm they suffered; fusion, in turn, mediated their intentions to donate time and money to the community. An exploratory analysis also revealed stronger fusion effects among participants who attributed the event to supernatural agency. The results show that fusion is not dependent on evidence of intergroup conflict, but also raise new questions about the importance of agentic attributions and search for meaning in the fusion process.

Keywords: Identity fusion; natural disaster; prosocial behavior; harm; emotion

The fusing power of natural disasters: An experimental study

A growing body of research has explored the necessary and sufficient conditions for fusion - the feeling of “oneness” with a group, in which the borders between the personal and social self are highly permeable - as well as the positive and negative self-sacrifices it can in theory produce. A number of studies have shown that fusion is a consequence of shared, self-defining traumatic experiences, such as war (Whitehouse, McQuinn, Buhrmester, & Swann, 2014), terrorism (Buhrmester, Fraser, Lanman, Whitehouse, & Swann, 2014) or sustained inter-group conflict (Jong, Whitehouse, Kavanagh, & Lane, 2015). In a correlational study, for example, Jong et al. (2015, Study 1) found that Unionists and Republicans in Northern Ireland who reported shared negative experiences felt more fused with their group, and the association was mediated by their tendency to reflect on those experiences. In an experimental, conceptual replication, Jong et al. found that Boston residents instructed to reflect on their experiences of 2013 Boston Marathon Bombing felt more fused with Boston, compared to those who reflected on a neutral experience, though the effect was limited to those who reported higher negative affect.

Although there is little doubt that shared trauma can produce identity fusion, the empirical focus on trauma caused by intergroup conflict obscures whether such conflict is necessary for producing it. That is, it is not clear whether fusion is a product of *any* shared, memorable, self-defining negative experience, or whether it is dependent to some extent on a common enemy with the intention to cause harm. Indeed, Whitehouse, Jong, Buhrmester, Gómez, et al. (2017) recently proposed that negative experiences that are not caused by a defined enemy, such as natural disasters, should be less fusing than negative experiences that pit groups against each other. Their argument is based on fusion’s purported adaptive function. Feeling fused with one’s group, it is proposed,

evolved as mechanism to motivate self-sacrifice in the context of intergroup conflict. Individuals who feel fused after shared negative encounters with outgroup members are more likely to contribute selflessly in subsequent encounters, thereby compensating for the ingroup's likely weakened position. The same motivation in the context of other negative events should not confer the same advantages, and indeed could be counterproductive to group flourishing if, for example, it motivated unnecessary or pointless sacrifices by group members. Consequently, the effects of shared trauma should in theory be sensitive to its source, increasing fusion among group members more, or only, when there is a salient threat from an outgroup. Consistent with this hypothesis, Whitehouse et al.'s (2017) mathematical model of the fusion process predicts more prosocial behavior when groups compete against other groups than when they face natural threats and, indeed, the researchers found that American participants were more willing to cooperate with other Americans after thinking about a hypothetical terrorist attack than after a hypothetical natural disaster.

These initial insights notwithstanding, most data on the fusing or defusing effects of natural disasters have been anecdotal or observational, and inconsistent. Although community resilience and spirit are almost inevitably praised following such events (most recently in the wake of Hurricane Harvey; see, e.g. Harbage & Kellman, 2017), historically, disaster victims' behavior has not been consistently benevolent. For example, Hurricane Katrina, which was one of the most devastating storms in U.S. history ("*Hurricanes in History*", n.d.), did indeed bring out altruism, self-sacrifice, and community-mindedness (e.g., volunteer rescue operations; free hotel accommodation for stranded guests; Rodríguez, Trainor, & Quarantelli, 2006), but also antisocial behavior such as looting (Barsky, Torres, & Trainor, 2006) and intergroup aggression (Kimmelmeier, Broadus, & Padilla, 2008). Even when communities pull together in

times of crisis, Kaniasty & Norris (2004) have noted that their prosociality deteriorates over time, and many cities see permanent depopulation, suggesting that residents do not feel particularly fused with the traumatized community. New Orleans itself has never returned to its pre-Katrina condition, with high numbers of displaced people (especially African-Americans) who have never returned to the city (Fussell, Sastry, & Vanlandingham, 2010), and high levels of inter-racial mistrust (Pyles & Cross, 2008). Of course, there are multiple reasons for such apparent “de-fusion,” including disruptions to social networks and activities, damage and changes to familiar infrastructure, and escalating stress and anger over the pace of recovery or the availability of resources (Kaniasty & Norris 2004). Nevertheless, the fact that natural disasters sometimes cause communities to fall apart argues against any simple model in which they inevitably fuse them together.

One of the few scientific studies of the fusing effects of a natural disaster examined the May 2012 Emilia earthquakes in northern Italy. Though not as deadly as the August 2016 earthquake in northern Italy, the 2012 event took the lives of 27 people, affected 59 towns and displaced 19,000 families. Vezzali, Drury, Versari, & Cadamuro (2016) measured PTSD symptoms among children who lived through the earthquake, who also indicated the extent to which “Children involved in the earthquake belong to the same group,” and their fusion with and willingness to help another (hypothetical) child earthquake victim. Their results showed that PTSD symptoms predicted fusion and one-group judgments, which mediated helping intentions, suggesting that shared trauma can indeed fuse its victims even when it is not caused by a salient outgroup, at least when those victims have been psychologically traumatized. However, the correlational nature of the study limits the conclusions that can be drawn;

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3 it is just as likely that children's pre-existing fusion with their communities made them
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5 more vulnerable to psychological trauma when those communities were damaged.
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8 In the current study we employed an experimental approach to test the causal
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10 role of a specific trauma that does not involve an outgroup – the devastating February
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12 2011 earthquake in Christchurch, New Zealand's third largest city (population 376,700
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14 at the time) – on residents' fusion with their community. The magnitude 6.3 quake
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16 killed 185 people, injured thousands more, and caused widespread damage to both the
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18 central business district and to private dwellings, many of which have yet to be, or will
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20 never be restored. Following a similar method to Jong et al. (2015, Study 3), we asked
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22 study participants, all of whom were living in Christchurch in 2011, to recall and record
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24 their experiences on the day of the earthquake, before measuring their fusion with the
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26 Christchurch community (control participants completed the recall task only after the
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28 dependent measures). We also measured participants' affect and self-reported trauma,
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30 anticipating that they might vary as a function of earthquake recall, or (as in Jong et al.,
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32 2015 and Vezalli, Drury, Versari & Cadamuro, 2016) moderate the effects of recall on
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34 fusion. Specifically, if a shared natural disaster has the power to fuse victims with their
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36 community, then we would expect Christchurch residents who recall the earthquake to
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38 feel temporarily more fused with other residents, perhaps especially (or only) when they
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40 have been personally traumatized and/or are experiencing negative affect. We also
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42 predicted that fusion would, in turn, predict downstream effects on participants'
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44 willingness to help fellow Christchurch residents.
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48 Finally, we explored the idea that the fusing power of natural disasters, if any,
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50 might depend in part on the attribution of the event. In particular, we note that natural
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52 disasters differ from terrorist activity (for example) not only in terms of outgroup
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54 salience, but also in terms of agency: an attack, but not an earthquake, is the result of a
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person or group with the *intention* to cause harm. Although it is unlikely that people blame other humans for causing earthquakes (though they may blame them for their suffering; Arceneaux & Stein, 2006), they may well see supernatural agency in such events (Heywood & Bering, 2013). Therefore, we included two measures of supernatural attribution – the beliefs that the disaster “happened for a reason” and that “God had a role” in it. To the extent that fusion depends on agency, reflecting on the earthquake may have more powerful effects for those who believe it was a nonrandom event.

Method

Participants

We aimed to recruit 200 participants who had been 18 years or older at the time of the earthquake and had lived in Christchurch, New Zealand at any point between the years 2009 and 2014 (the year in which the data were collected). ~~This sample size provided a statistical power (1 – β) of 0.73 when $\alpha = .05$, two-tailed to detect an effect of condition \times psychological harm on levels of fusion ($f^2 = 0.05$), according to G*Power 3 software (Faul, Erdfelder, Lang, & Buchner, 2007).~~ Qualtrics Panels Management ~~(through Qualtrics.com interface)~~ recruited a total of 239 participants, 36 of whom were excluded for not living in Christchurch at the time of the earthquake, or for having failed an attention check (see below). Most of the participants, (112 female, 91 male, $M_{age} = 52.32$, $SD_{age} = 16.66$, range 22-84) reported English as their native language (87.2%), were citizens of New Zealand (84.5%) and classified themselves ethnically as “New Zealand European” (84.2%). (The largest minorities were of full or partial Chinese descent [8%] and of Maori descent [3.1%.]) About half (55.2%) identified as religious,

nearly all of whom (54.6%) were Christian; the remainder (45.8%) reported their religious orientation as either atheist or “none.” [A sensitivity analysis using G*Power 3 software \(Faul, Erdfelder, Lang, & Buchner, 2007\) indicated that this sample is sufficient to detect a significant interaction effect of \$f^2 = .04\$ in a multiple regression with statistical power \(1- \$\beta\$ \) of .80 when \$\alpha = .05\$.](#)

Manipulation and measures

Following Jong et al. (2015), participants in the experimental (“recall”) condition were presented with the following task at the beginning of the survey:

We would now like you to recall – as vividly as you can – the Christchurch Earthquake that took place in February 2011. What happened during the Earthquake? Where were you when it happened? Did it affect you or anyone you know directly? How did it make you feel?

Participants were asked to type their recollections and experiences into a response box. As a control for individual differences in recall ability, participants’ visualization of the earthquake was measured by two questions based on the Vividness of Visual Imagery Questionnaire (VVIQ, Marks, 1973), in which participants rated the clarity and detail with which they visualized and the earthquake on a 9-point scale anchored at “Very unclear / Very little detail” and “Very Clear / Very Detailed”. Due to the potential sensitivity of the topic, participants were given an option to skip the recall task if they wished (13 participants did so).

Participants’ current affective state was measured in two ways. First, affect was assessed dimensionally with Mehrabian and Russell’s (1974) 18-item questionnaire, including valence, arousal, and dominance subscales. Second, basic emotional states – happy, sad, afraid, angry, surprised and disgusted – were assessed on 9-point scales anchored at “Not at all” and “Very much so” (Gross & Levenson, 1993).

Participants' fusion with Christchurch was measured with two instruments: Swann et al.'s (2009) pictorial fusion scale, and Gómez, Brooks, Buhrmester, Vázquez, Jetten & Swann's (2011) verbal scale. In the pictorial scale, participants were presented with seven Venn diagrams (increased from the original scales' five to allow more variance (see supplementary online material, Figure S1), each with two circles labeled "Self" and "Christchurch" with increasing degrees of overlap. Participants were asked to select the diagram that best represented their relationship with Christchurch, defined as "the people, communities, groups, neighborhoods, etc. in the greater Christchurch area." In the verbal scale, participants rated their agreement with each of seven fusion-related statements ("I have a deep emotional bond with the city of Christchurch"), using a 9-point scale anchored at "Not at all" to "Very much so".

Four different aspects of harm were assessed using a series of self-report questions, which appear in Table 1: harm to the participant; damage to the participant's home environment; damage to the participant's work environment; and mortality salience (an additional question assessing the general effect on the participant's life was included but not analyzed here). Participants rated the levels of harm suffered using a 9-point scale anchored at "Not at all" to "Very much so," or gave yes/no responses as appropriate. Participants were given an option to skip the harm questions if they wished (11 participants did so).

Prosocial behavior was measured with two items. First, participants were informed, truthfully, that a \$100 bonus would be awarded to three randomly chosen participants in the survey, and asked how much if any of the bonus they would willing to donate to a fund for "people who have been affected" by the earthquake. Second, participants were asked if they would like their contact details given to volunteer groups if any such groups were to request help from the experimenters and, if so, how many

hours they would be willing to commit per month. Participants were reminded that their payment for the completion of the survey would be independent of their responses to these questions.

Table 1. Harm questions.

Aspects of Harm	<i>M</i>	<i>SD</i>
Personal Harm		
To what extent did you suffer psychological harm as a result of the February 2011 Christchurch earthquake?	3.16	2.52
To what extent did you suffer physical harm as a result of the February 2011 Christchurch earthquake?	0.83	1.75
Damage to the Environment		
To what extent was your home damaged by the February 2011 Christchurch earthquake?	3.21	2.20
To what extent was the area where you live damaged by the February 2011 Christchurch earthquake?	3.70	2.32
Workplace Harm		
To what extent was your workplace damaged by the February 2011 Christchurch earthquake?	4.30	2.64
To what extent was the area where you work damaged by the February 2011 Christchurch earthquake?	4.70	2.67
Mortality Salience		
Have any of your friends or family been physically injured because of the February 2011 Christchurch earthquake?	20%	
Did you witness the injury?	1%	
Did you know anyone who was killed in the February 2011 Christchurch earthquake?	38.5%	
To what extent did you feel your life was in danger during the February 2011 Christchurch earthquake?	4.68	2.60

Note: Question type (in bold) was not provided to participants. Workplace harm questions were only presented to participants who were employed at the time of the earthquake (n = 127).

Two exploratory measures were also included to assess the role of supernatural beliefs in the fusion process: (1) “To what extent do you feel that the February 2011 Christchurch earthquake had a purpose or happened ‘for a reason’?” and (2) “To what extent do you think God had a role in the February 2011 Christchurch earthquake?”

Participants answered both questions on 9-point scales anchored at “Not at all” and “Very much so”.

Procedure

Participants were directed to an online survey titled: “Attitudes Toward Your City: Christchurch Edition” hosted by Qualtrics, where, after giving informed consent, they were randomly assigned to an experimental or control condition. Participants in the experimental condition were asked to recall their experience of the earthquake, and then to rate their visualization of the recall, emotions at the time of completing the survey, levels of fusion, and prosocial behavior, always in that order. The procedure in the control condition was identical, except that participants were not given the recall task (and measure of its visualization) until after they completed the dependent measures. Thus, control participants were not aware of our interest in the earthquake when they completed the measures of affect, fusion and prosocial behavior. Finally, all participants answered the harm and supernatural attribution questions, and provided demographic information. They also completed an attention check at the end of the survey, before being debriefed.

Results

Eight additional participants who indicated (subsequent to the initial screening procedure) that they were not in fact living in Christchurch at the time of the earthquake, were excluded from analysis. Because a small proportion of participants bypassed certain sections of the survey (with permission; see above), sample sizes vary slightly across analyses

Effect of recall, emotional state, and harm on fusion

Participants' responses on the pictorial fusion scale, were recoded to a 9-point scale, as explained in <http://www-01.ibm.com/support/docview.wss?uid=swg21482329>, to make it directly comparable with the verbal scale. The two scales correlated strongly, $r(195) = .67$, so the two were averaged to form a single "fusion" index, such that higher values reflect stronger fusion with Christchurch. The visualization items were also highly correlated $r(188) = 0.82$, and were averaged into single "visualization" measure. Visualization did not qualify any of the results reported below, however, and is not discussed further.

Emotion. A MANOVA revealed no effects of recall condition on any of the affect measures, all $ps > .15$. Consequently, we proceeded to examine the moderating role of each measure, using Hayes (2012) PROCESS procedure (model 1) for SPSS, with 5,000 bootstrap resamples, treating experimental condition as the independent variable, fusion as the dependent variable, and each affect subscale (valence, arousal, dominance, and individual emotion items) in turn as a moderator (all predictors were centered in all analyses). For dimensional affect, results revealed significant main effects for all three dimensions, with positivity, greater arousal, and higher dominance associated with stronger fusion (supplementary online material, Table S1). There were no significant interactions, although there was a trend, as in Jong et al.'s (2015) research, for recall to be associated with greater fusion for participants reporting more negative affect, interaction $b = -.12 [-.27, .03]$, $p = .12$.

For the basic emotion items, only happiness $b = .26 [.12, .40]$, $p = .0002$, and fear, $b = -.15 [-.30, -.01]$, $p = .03$, reliably predicted fusion (there was no main effect of recall condition in any analysis). More importantly, fear alone significantly interacted with recall condition, $b = .19 [.05, .33]$, $p = .008$; fear was negatively associated with

fusion in the control condition, $b = -.33 [-.52, -.14]$, $SD = 0.1$, $p = .001$, but not in the recall condition, $b = .04 [-.16, .25]$, $SD = .10$, $p = .67$. Seen another way, earthquake recall had an increasingly positive effect on fusion with increasing levels of fear; a Johnson-Neyman analysis indicated that recall effects were significant above values of .34 on the fear scale, which included 30% of participants. The interaction is depicted in Figure 1, and full analyses are reported in the supplementary online material, Table S1.

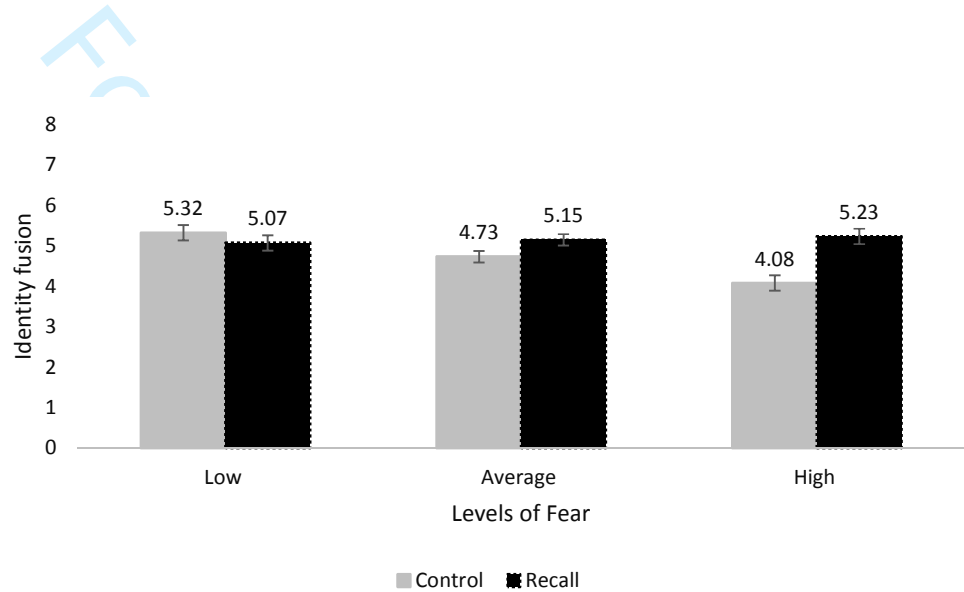


Figure 1. Identity fusion at the mean, and one SD above and below the mean, of reported fear. Error bars represent standard errors.

Harm.

Several of the items that were included to assess different aspects of harm (see Methods, and Table 1 for descriptive statistics) were not suitable for analysis. In particular, only 20% of participants had friends or family who were injured, and only two people had personally witnessed an injury (interestingly, approximately one third of participants claimed to have suffered at least minor injuries themselves, and 38% of participants knew someone who was killed). Furthermore, the questions regarding workplace damage were not included because fewer than two thirds of participants were employed

at the time of the earthquake, and because of conceptual redundancy with the environmental harm variable. Thus, we focused on three aspects of harm: harm to the participant, damage to the participant's environment, and mortality salience, each computed as the average of the two items in each category. None of the harm indices was influenced by experimental condition, $ps > .3$.

As with emotional states, we examined the main and interactive effects of harm on fusion using PROCESS, treating experimental condition as the independent variable, fusion as the dependent variable, and each dimension of harm as a moderator in turn. The analyses revealed no main effects, and one interaction between recall and personal harm, $b = .23$ [.08, .38], $p = .003$; harm was associated with weaker fusion in the control condition, $b = -.31$ [-0.54, -.08], $SD = .12$, $p = .01$, but greater fusion in the recall condition, $b = .16$ [-0.05, .36], $SD = .10$, $p = .14$. Seen another way, recall produced increasingly greater fusion relative to the control condition, as personal harm increased; a Johnson-Neyman analysis indicated that recall effects were significant above values of .36 on the personal harm index, which included 41% of participants. The interaction is depicted in Figure 2, and full analyses are reported in the supplementary online material, Table S1.

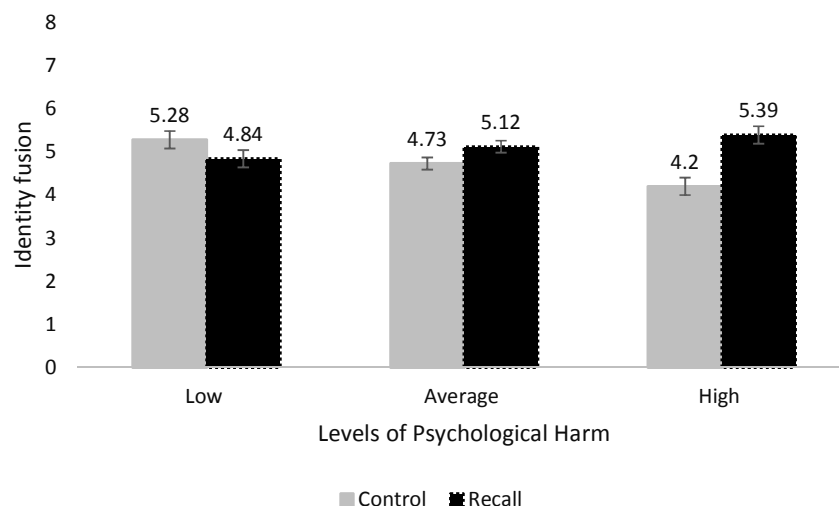


Figure 2. Identity fusion at the mean, and one SD above and below the mean, of personal harm. Error bars represent standard errors.

The effects were maintained, albeit in weakened form, even when the two significant moderators –fear and personal harm – were considered simultaneously, using PROCESS, Model 2, (Hayes, 2013), suggesting that higher levels of both predict stronger effects of earthquake recall on fusion, independent of one another.

Prosocial behavior.

A minority of participants expressed interest in donating time (22.1%) or money (34.9%) to the rebuild effort. To create a more sensitive measure, we combined the two measures into a dichotomous index reflecting whether a participant was willing to make *either* type of contribution. There was no direct effect of recalling the earthquake on likelihood of acting prosocially, $F(1, 193) = .021, p = 0.88$, which was correlated with fusion $r(195) = .17, p < .05$.

To test the hypothesis that the interactions of earthquake recall with fear and personal harm in the analyses above, influenced prosocial behavior via their effects on fusion (i.e., moderated mediation; see Figure 3), we employed Hayes’ (2012) PROCESS model 9 with 5,000 bootstrap resamples. The results confirm an indirect effect of recall condition through its interaction with both fear (index of partial moderated mediation = .02 [-.0008, .078]), and, independently, with personal harm (index of partial moderated mediation = .03 [.0009, .0954]). The effects appear in Figure 3.

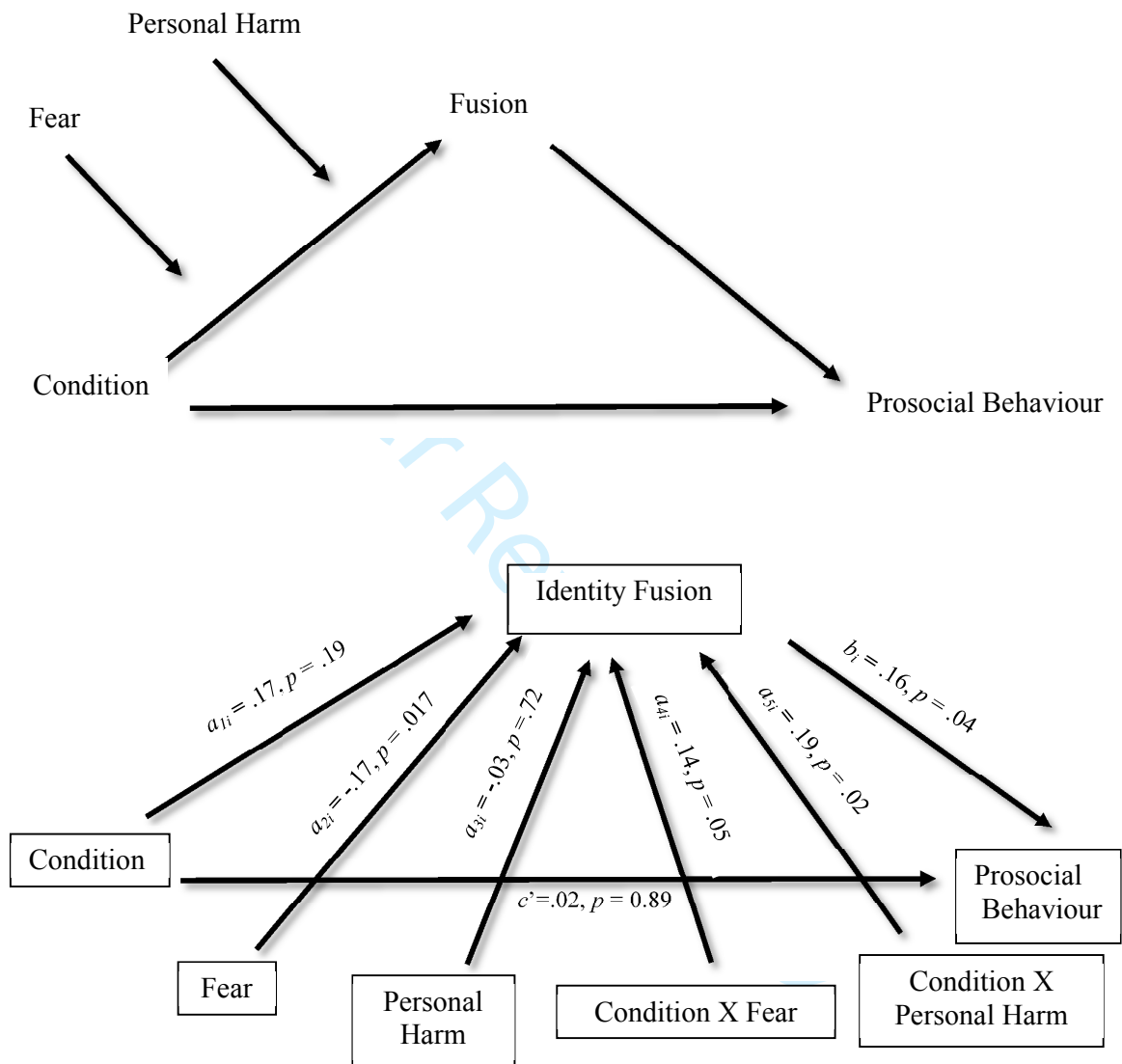


Figure 3. Conceptual (top panel) and statistical models of the effect of earthquake recall on prosocial behavior, mediated by independent interactions with fear and personal harm on fusion.

Supernatural attributions

For exploratory purposes, we included two measures of supernatural attribution – whether the earthquake “happened for a reason” and whether God had a hand in it, neither of which was directly influenced by earthquake recall, $F(1, 184) = .166, p = .69$, and $F(1, 184) = .001, p = 0.99$. The two measures were correlated, $r(186) = .59$, and so were averaged into a single index of supernatural agency, and tested as a moderator of the effect of recall condition on fusion. The model revealed an overall negative effect of agency, $b = -.16 [-.31, -.02], p = .03$, which interacted with recall condition, $b = .15 [.005, .29], p = .04$; agency was negatively associated with fusion in the control condition, $b = -.31 [-.52, -.1], SD = .24, p = .004$, but not in the recall condition, $b = -.01 [-.21, .19], SD = .10, p = .92$. Seen another way, recall produced increasingly greater fusion relative to the control condition, as perceived agency increased; a Johnson-Neyman analysis indicated that recall effects were significant above values of .66 on the agency index, which included 22% of participants. An analysis of moderated mediation (PROCESS, Model 7) also revealed a marginally significant indirect effect of the interaction on prosocial behavior, via fusion (index of moderated mediation = .02 [-.001, .08]).

Discussion

Identity fusion has recently emerged as a construct, functionally related to but distinct from group identification, that promises to explain a host of seemingly paradoxical phenomena, from painful rituals (Whitehouse & Lanman, 2014) to suicide bombing (Swann, Gómez, Dovidio, Hart & Jetten, 2010). Much is unknown, however, about fusion’s antecedents and its consequences. In particular, while fusion should follow, theoretically, from shared, self-defining dysphoric experiences, it is unclear the

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2
3 importance of the source or attribution of that experience.

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5 Previous research in the field has focused on traumatic events caused by
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7 outgroups (Buhrmester, Fraser, Lanman, Whitehouse, & Swann, 2014; Jong,
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9 Whitehouse, Kavanagh, & Lane, 2015), and although this work has yielded important
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11 insights, it has left unclear whether outgroups are a necessary component of the fusion
12
13 process. Indeed, our initial prognosis for outgroup-unrelated fusion was not promising.
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15 In theory, fusion's evolved function is to elicit group commitment and sacrifice at times
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17 when the group is most vulnerable – presumably when it is under existential threat from
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19 an outgroup (Swann et al., 2012). It is not at all clear that such commitment and
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21 sacrifice is necessary, or even desirable, when the cause of a group's trauma is not
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23 another group, but nature, which may pose no immediate additional threat.
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27 Furthermore, despite some anecdotal and correlational evidence to the contrary
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29 (e.g., Vezalli, Drury, Versari & Cadamuro, 2016), it is not clear that groups *do* emerge
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31 from natural traumas more fused. There is little doubt that survivors of natural disasters
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33 do rally to each other's aid, but people's altruism and commitment may be time-limited
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35 (Kaniasty & Norris, 2004), and there is no evidence that traumatized communities
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37 ultimately emerge from disasters more fused than before. Indeed, from a theoretical
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39 perspective, it is equally plausible that natural disasters will fractionate communities,
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41 not only because intergroup identity and conflict increase when resources are scarce
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43 (LeVine & Campbell, 1972), but also because disaster preparedness, impact, and
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45 recovery are often unevenly distributed along ethnic or socioeconomic lines (Fothergill,
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47 Maestas, & Darlington, 1999; Kaniasty & Norris, 1995). Consistent with the de-fusion
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49 hypothesis, a study conducted after the 2012 Emilia Earthquake found that Italian
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51 participants who were primed with negative contact with an immigrant generalized the
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53 incident to decrease their support for policies aimed at favoring immigrant survivors
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(Vezzali, Andrighetto, Di Bernardo, Nadi, & Bergamini, 2016). Although there has been no systematic analysis of community fusion following natural disasters, there are salient examples, such as post-Katrina New Orleans, in which at least some residents appear less trusting and trustworthy in the years that follow (Pyles & Cross, 2008).

Thus, the current study is important, first, for providing experimental evidence that natural disasters *can* both fuse their victims and produce downstream affect and prosocial behavior. Residents of Christchurch, New Zealand, all of whom had been present for and affected by the city’s most significant earthquake on record, reported greater fusion with “the people, communities, groups [and] neighborhoods” of the city when they were asked to bring their experiences to mind (compared to a control group). But, consistent with Jong et al.’s (2015) findings, fusion depended on participants’ negative affective state and, independently, on the personal harm they believed they had suffered. Furthermore, fused participants were more likely to commit to helping other victims of the earthquake, either by donating time or (more often) money. Interestingly, fusion and its downstream effects did not depend on damage to participants’ *property*, tentatively calling into question the importance of post-quake resource depletion; it was the harm that participants themselves suffered, not the loss of personal possessions, that mattered. It is also noteworthy that participants did not report greater fusion with increasing mortality salience (in the form of personal fear of, or exposure to death), as might be predicted from Terror Management Theory’s worldview defense hypothesis, which proposes that individuals reinforce their group memberships as a primary way of managing their fear of death (Pyszczynski, Greenberg, & Solomon, 1999). Indirectly, then, the results call into question the equivalence of fusion and group identification, and the plausibility of the former as mechanism of worldview defense.

Although we interpret the results in terms of an increase in fusion following earthquake recall, particularly among those reporting negative affect and experience, it is important to note that the increase is relative to a control condition in which these variables are negatively correlated. With no reminders of the earthquake, Christchurch residents who reported greater chronic fear and negative outcomes also reported less fusion with the city. We can only speculate about the cause of this correlational relationship, which is independent of our experimental manipulation and question. One interesting possibility, however, is that chronic suffering (and or factors associated with it, such as trust in government) can sour victims on groups they deem complicit in it. If so, one could hypothesize multiple processes associated with trauma, running on different time scales, such that acute suffering (and reliving it, as in the current study) fuses groups, but undermines them in the long term. Such a proposal would be consistent with the decline of community spirit and prosocial behavior over time following natural disasters (Kaniasty & Norris, 2004), as victims' personal memories of the original event fade. It would also suggest a practical means of maintaining fusion in post-disaster communities, by nudging victims to remember how they themselves were personally affected by the original event. Further research is required to understand both the relationship between affect and fusion, as well as how time may play a role in it. The city's residents feel the damage and loss of the earthquake acutely, even seven years after the event, in part because the city's reconstruction and recovery are still in progress. As they are completed, and as personal traumas become less salient, the relations among affect, harm, fusion, and prosocial behavior may change as well.

Although the current findings are important as an existence proof – natural disasters can, under the right conditions, promote fusion among its victims – we were not able to include a second, outgroup-relevant trauma in the design, so we are unable to

1
2
3 make claims about the relative effects of the two types of events. We suspect, however,
4
5 that negative experiences caused by outgroup members would produce stronger effects
6
7 than when no one is to blame (Whitehouse et al., 2017). Although the mechanisms of
8
9 fusion in the current study have yet to be determined, they need not constrain the
10
11 adaptive logic of outgroup-dependent fusion (Whitehouse et al., 2017). Thus, personally
12
13 damaging negative events should be particularly fusing when fusion can function to
14
15 prepare the ingroup for further outgroup threat. This hypothesis could be tested, in
16
17 principle, in a study that manipulates the attributions of the same negative event, for
18
19 example, a hurricane attributed to random weather patterns versus willful inattention to
20
21 global warming.
22
23

24 The comparison between outgroup dependent and independent trauma reveals
25
26 another interesting distinction, one that has not been considered in the literature:
27
28 “outgroup-relevance” is not the only dimension on which terrorist attacks (for example)
29
30 and natural disasters differ: the former, but not the latter, are caused by *agents*: persons
31
32 or groups with the intention to do harm. Because outgroup attribution and intentionality
33
34 are naturally (though perhaps not inevitably) confounded, it will be difficult to separate
35
36 the perception that an outgroup or outgroup member caused an event, from the
37
38 perception that they *intended* to do so. Our exploratory analysis of supernatural
39
40 attribution is especially interesting from this perspective. Results indicate that recall
41
42 promoted greater fusion when the earthquake was perceived agentically, suggesting
43
44 that, if outgroup-instigated disasters are more fusing than natural ones, it may be
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46 because the intentionality behind them is more evident – a proposition that could be
47
48 tested by manipulating agency directly, examining whether, for example, a forest fire is
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50 less fusing when caused by a lightning strike than by an arsonist.
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1
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3 In sum, the current study provides the first experimental evidence that negative
4
5 events need not be caused by threatening outgroups to produce fusion, though there is
6
7 some evidence that their cause must be agentic. Natural disasters, with nobody to
8
9 blame, can fuse their victims too, at least among those who personally suffered the
10
11 most. The changes in fusion in the study were small, but so (necessarily) was the
12
13 experimental manipulation (our goal was to make earthquake experiences salient for
14
15 participants, not to re-traumatize them), and although readers should be cautious about
16
17 extrapolating the results to the immediate aftermath of a natural disaster, there is no
18
19 reason to suppose that the current paradigm has not captured, in microcosm,
20
21 generalizable aspects of the fusion process. Likewise, we acknowledge that the
22
23 prosocial commitments assessed here were merely hypothetical, and no doubt easier to
24
25 acquire as a result, but we also note that intentions are a critical predictor of actual
26
27 behavior (Ajzen & Fishbein, 1980). Future studies should continue to examine the
28
29 parameters and mechanisms of fusion by shared negative events, not only to understand
30
31 the nature of this fundamental intergroup process, but also to identify how communities
32
33 can work together more effectively after natural disasters.
34
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42
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44
45 designing the experiment.
46
47
48

49 **Author Contributions**

50
51 Conceived and designed the experiments: KS JH JJ; performed the experiments: KS;
52
53 Analyzed the data: KS JH; Wrote the paper: KS JH
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Supplement Material: The fusing power of natural disasters: An experimental study

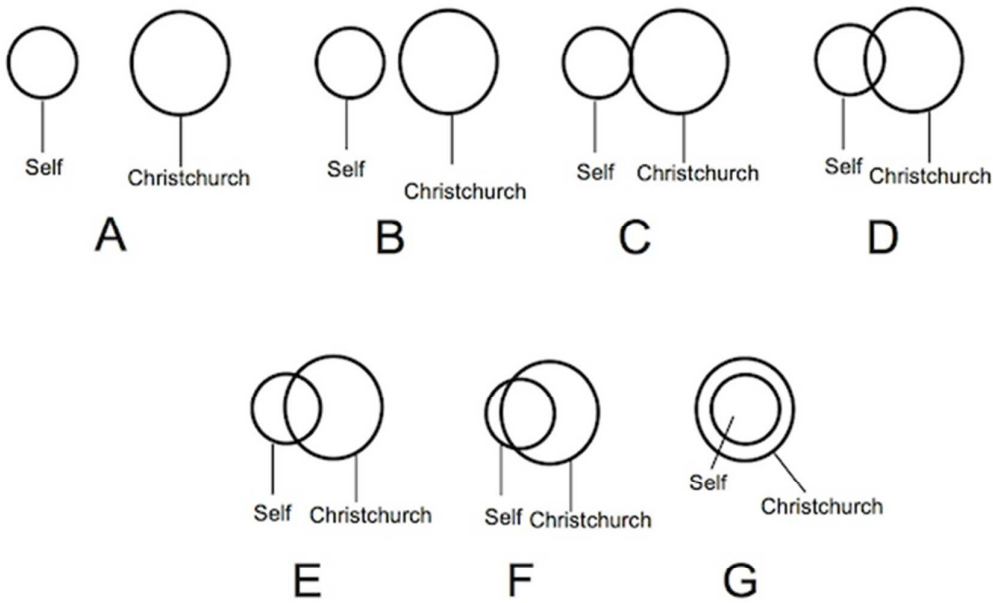


Figure S1. Pictorial Fusion Measurement with seven Van diagrams based on Swann et al. (2009)

Table S1. Moderation models reported in the main text

	<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>	LLCI	ULCI	Overall Model <i>R</i> ²
Valence	.27	.07	3.63	.0004	.12	.42	0.09
Condition	.21	.14	1.57	.12	-.05	.48	
Condition x Valence	-.12	.07	-1.56	.12	-.27	.03	
Arousal	.63	.11	5.74	.001	.42	0.85	.16
Condition	.21	.13	1.59	.11	-.05	.47	
Condition x Arousal	.03	.11	.24	0.81	-.19	.25	
Dominance	.35	.12	2.99	.003	.12	.59	.06
Condition	.26	.14	1.87	.06	-.01	.53	
Condition x Dominance	-.11	.12	-0.95	.34	-.35	.12	
Happy	.26	.07	3.8	.0002	.12	.40	0.09
Condition	.22	.14	1.62	.11	-.05	.49	
Condition x Happy	-.09	.07	-1.3	.19	-.22	.05	
Sad	-.09	.07	-1.33	.18	-.22	.04	.03
Condition	.22	.14	1.60	.11	-.05	.50	
Condition x Sad	.09	.07	1.35	.18	.04	.22	
Afraid	-.15	.07	-2.17	.03	-.30	-.01	.07
Condition	.21	.14	1.54	.13	-.06	.48	
Condition x Afraid	.19	.07	2.66	.008	.05	.33	
Angry	-.11	.07	-1.63	.11	-.25	.02	.03
Condition	.23	.14	1.65	.10	-.05	.51	
Condition x Angry	.08	.07	1.12	.27	-.06	.21	
Surprised	.12	.08	1.61	.11	-.03	.28	.03
Condition	.22	.14	1.57	.12	-.06	.50	
Condition x Surprised	.01	.08	.18	0.89	-.14	.17	
Disgusted	-.08	.07	-1.15	.25	-.22	.06	.02
Condition	.21	.14	1.46	.15	-.07	.48	
Condition x Disgusted	.03	.07	.36	.72	-.11	.16	
Personal Harm	-.08	.08	-1.06	.29	-.24	.07	.06
Condition	.19	.14	1.41	.16	-0.08	.47	
Condition x Personal Harm	.23	.08	2.98	.003	.08	.38	
Harm to the Environment	-.09	.07	-1.34	.18	-.22	.04	.02
Condition	.18	.14	1.32	.19	-.09	.46	
Condition x Environment	.01	.07	.15	0.88	-.12	.14	
Mortality Salience	.03	.11	.26	.79	-.19	.24	.01
Condition	.16	.14	1.13	.26	-.12	.45	
Condition x Mortality	.11	.11	1.01	.32	-.10	.32	
Supernatural Attributions	-.16	.07	-2.23	.03	-.31	-.02	.06
Condition	.19	.14	1.38	.17	-.08	.46	
Condition x Supernatural	.15	.07	2.03	.04	.005	.29	

The fusing power of natural disasters: An experimental study

Stimulus material: online survey (experimental condition)

(Note: Q1-Q8 involve information and consent forms.)

Q9: The following section of this survey concerns the February 2011 Christchurch Earthquake. If you would like to proceed with this section, please click Continue; if you would prefer to skip this section, please click Skip.

- ☐ Continue
- ☐ Skip

Q10: We would now like you to recall--as vividly as you can--the Christchurch Earthquake that took place in February 2011. What happened during the Earthquake? Where were you when it happened? Did it affect you or anyone you know directly? How did it make you feel? Please write down your recollections of the event and your experiences in the space provided below:

Q11: The following questions are about how well you were able to visualise – just now – the February 2011 earthquake. Please use the following scale:

	Very unclear / Very little detail 1	2	3	4	5	6	7	8	Very Clear / Very Detailed 9
How clear was your visualization of the event?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How detailed was your visualization of the event?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12: Please indicate how you feel right now, using the scales below. Each scale on this page contains an adjective pair which you will use to rate how you currently feel. Some of the pairs may seem unusual, but you will probably feel more one way than another. So, for each pair, click the button closest to the adjective which you believe describes how you feel right now. The more appropriate the adjective seems, the closer the button you click should be.

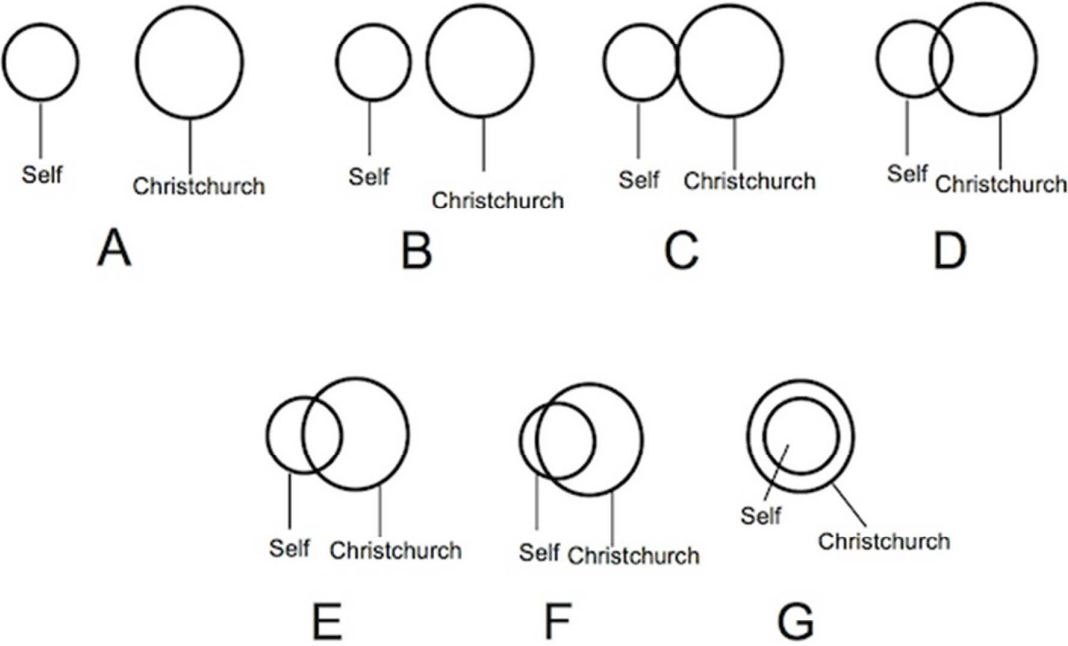
	1	2	3	4	5	6	7	8	9
Unhappy:Happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Annoyed:Pleased	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unsatisfied:Satisfied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Melancholic:Contented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Despairing:Hopeful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bored:Relaxed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relaxed:Stimulated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calm:Excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sluggish:Frenzied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dull:Jittery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sleepy:Wide-awake	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unaroused:Aroused	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Controlled:Controlling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Influenced:Influential	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cared for:In control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Awed:Important	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Submissive:Dominant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Guided:Autonomous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13: To what extent do you feel right now:

	Not at all so 0	1	2	3	4	5	6	7	Very much so 8
Happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Afraid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Angry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surprised	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disgusted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q14: This section contains questions about how you feel about Christchurch, at this moment in time.

Q15: Look at the images below...



Q16: Which pictorial representation above most closely reflects your relationship with Christchurch right now? The smaller circles in the image represent you and the larger circles represents Christchurch. Please pick one image. *Note: Christchurch is used to describe the people, communities, groups, neighborhoods, etc. in the greater Christchurch area.

- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☐ E
- ☐ F
- ☐ G

Q17: Below are a list of statements about Christchurch. Please read the statements and indicate on the scale to what extent you would agree with the statements right now: *Note: Christchurch is used to describe the people, communities, groups, neighbourhoods, etc. in the greater Christchurch area.

Q18: I am one with the city of Christchurch.

- ☐ Strongly Disagree 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ Strongly Agree 9

Q19: I feel immersed in Christchurch.

- ☐ Strongly Disagree 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ Strongly Agree 9

Q20: I have a deep emotional bond with the city of Christchurch.

- ☐ Strongly Disagree 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ Strongly Agree 9

Q21: Christchurch is me.

- ☐ Strongly Disagree 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ Strongly Agree 9

Q22: I'll do for Christchurch more than any of the other residents would do.

- ☐ Strongly Disagree 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ Strongly Agree 9

Q23: I am strong because of Christchurch.

- ☐ Strongly Disagree 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ Strongly Agree 9

Q24: I make Christchurch strong.

- ☐ Strongly Disagree 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ Strongly Agree 9

Q25:

*****Please note that your payment does not depend on and is not affected by any responses provided in this section *****

As a token of our appreciation, we will be awarding \$100 to three randomly chosen participants in this survey. If you win you may donate any portion of this money to help people who have been affected by the February 2011 Christchurch earthquake (through Christchurch City Council). If you would like to do so, please fill in the amount you want to donate below (enter a number and round to the nearest dollar). If you would prefer not to donate, just leave the space blank: _____

Q26: Several volunteer groups are active in Christchurch, and might contact us in their recruitment drive. If we are approached by such groups:

- ☐ Please forward my details to such groups as I would like to volunteer
- ☐ Please do not forward my details

Q27: Number of hours per month that I am willing to commit to volunteering:

Q28: The following section of this survey concerns the February 2011 Christchurch Earthquake. If you would like to proceed with this section, please click Continue; if you would prefer to skip this section, please click Skip.

- ☐ Continue
- ☐ Skip

Q29: We are now interested in the hardships you may have endured due to the February 2011 Christchurch earthquake. To what extent did you suffer physical harm as a result of the February 2011 Christchurch earthquake?

- ☐ Not at all 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ Very much so 8

Q30: To what extent did you suffer psychological harm as a result of the February 2011 Christchurch earthquake?

- ☐ Not at all 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ Very much so 8

Q31: To what extent was your home damaged by the February 2011 Christchurch earthquake?

- ☐ Not at all 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ Very much so 8

Q32: To what extent was the area where you live damaged by the February 2011 Christchurch earthquake?

- ☐ Not at all 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ Very much so 8

Q33: Were you employed at the time of the February 2011 Christchurch earthquake?

- ☐ Yes
- ☐ No

Q34: Please answer the following:

	Not at all 0	1	2	3	4	5	6	7	Very much so 8
To what extent was your workplace damaged by the February 2011 Christchurch earthquake?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To what extent was the area where you work damaged by the February 2011 Christchurch earthquake?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q35: Have any of your friends or family been physically injured because of the February 2011 Christchurch earthquake?

- ☐ Yes
☐ No

Q36: Did you witness the injury?

- ☐ Yes
☐ No

Q37: Did you know anyone who was killed in the February 2011 Christchurch earthquake?

- ☐ Yes
☐ No

Q38: To what extent did you feel your life was in danger during the February 2011 Christchurch earthquake?

- ☐ Definitely Not 0
☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7
☐ Definitely 8

Q39: Overall to what extent has your life been affected by the February 2011 Christchurch earthquake?

- ☐ Not at all 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ Very much so 8

Q40: To what extent do you feel that the February 2011 Christchurch earthquake had a purpose or happened "for a reason"?

- ☐ Not at all 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ Very much so 8

Q41: To what extent do you think God had a role in the February 2011 Christchurch earthquake?

- ☐ Not at all 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ Very much so 8

Q42: The following are some background questions, to ensure that we have a representative sample of participants.

Q43: How old are you, in years? (Please type in a number, rounding to the nearest year.)

Q44: What is your gender?

- ☐ Female
☐ Male
☐ Other

Q45: What is your ethnicity? (Tick as many boxes below as apply)

- ☐ New Zealand European
☐ Māori
☐ Chinese
☐ Other (please specify) _____

Q46: What is your nationality?

Q47: How many years have you lived in New Zealand? If you do not currently live in New Zealand, how many years in total had you lived in New Zealand before moving away? (Please type in your answer as a number, rounding to the nearest year). _____

Q48: How many years have you lived in Christchurch? If you do not currently live in Christchurch, how many years in total had you lived in Christchurch before moving away? (Please type in your answer as a number, rounding to the nearest year)_____

Q49: If you were living in Christchurch at the time of the February 2011 Earthquake, what was your post code?

Postcode _____

Q50: Do you currently live at this address?

- ☐ Yes
☐ No

Q51: When did you move away from this address (month/year)?

Q52: When did you move away from this address? (please enter numbers)

Month: _____

Year: _____

Q53:

What is your current post code? _____

How long have you been living at this post code?

Years: _____

Months: _____

- Q54: Religion (please check only one)
- ☐ Christian
 - ☐ None
 - ☐ Other (please specify) _____

Q55: People differ on how strongly they feel about their position on religious matters, whether they do or do not believe. Think about your own beliefs about religion. How important are your beliefs about religion to you?

- ☐ Not at all important 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ Very Important 8

Q56: Please rate your English:

- ☐ Native English
- ☐ Non-native but excellent
- ☐ Good
- ☐ Ok